

EFFECT OF REDUCED WATER TEMPERATURE ON FISHES OF TAMPA BAY, FLORIDA

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ESTUARIES connected with the Gulf of Mexico are characterized by extensive shallow water areas which at times are subjected to rapid temperature fluctuations. The reaction of marine organisms to environmental changes is of importance to biologists engaged in estuarine ecological research. Instances of massive fish mortality, especially among sublittoral species, have resulted from a marked lowering of water temperature. Gunter (1941) and Gunter and Hildebrand (1951) reported such occurrences on the Texas coast. Fish kills attributed to rapid temperature reduction have also been recorded from the Florida Gulf coast by Storey and Gudger (1936) and Springer and Woodburn (1960).

During the evening of December 12, 1962, northwest winds of 20-30 mph. and a low air temperature of 18.3°F were recorded in the Tampa Bay area. This was the coldest temperature reported since the initiation of records in 1890. These severe conditions made it possible to observe the effects of rapid temperature depression on fish in Tampa Bay.

Two major fish kills were observed. The first occurred on the morning of December 13 in Old Tampa Bay below the dam of Bass Lake, a freshwater impoundment (fig. 1). This site is a brackish-water, mud-bottom habitat having an annual salinity range of 4 to 28 o/oo. Water depth varies from two to four feet. On the following morning, December 14, another kill was noted in Boca Ciega Bay, north of Pass-a-Grille channel (fig. 1). These waters range in salinity from 28 to 36 o/oo and in depth from 4 to 12 feet. There are numerous channels and fills in the area. Water temperatures at the two locations are similar.

OBSERVATIONS

Water temperature in Old Tampa Bay ranged from 14.3 to 15.0°C on December 10. During the fish kill of December 13, a surface water temperature of 9.6°C and a salinity of 14.42 o/oo were recorded at 9 a.m. The bottom was completely covered with fish in an area 50 feet square at a depth of two feet. Most of these

TABLE 1

Species of fish affected by lowered temperature on December 13-14, 1962, in Tampa Bay, Florida

Area and Date	Water Temp. (°C)	Sal. (o/oo)	Species	Size Range (mm.)	Total Number Collected	Condition
Bass Lake,	9.6	14.42	<i>Diapterus plumieri</i> °	55-108	152	Dead, few stunned
Old Tampa Bay (Dec. 13)			<i>Ictalurus nebulosus</i>	92-104	6	Dead
			<i>Eucomostomus argenteus</i>	40-64	5	Dead
			<i>Mugil trichodon</i>	62-110	2	Dead
			<i>Centropomus undecimalis</i>	123	1	Dead
Pt. Pinellas, Central Tampa Bay (Dec. 13)	11.2	28.24	<i>Eucomostomus gula</i>	46-50	2	Stunned
			<i>Lutjanus synagris</i>	115	1	Stunned
			<i>Chilomycterus schoepfi</i>	105	1	Dead
			<i>Synodus foetens</i>	53	1	Dead
Big Bayou, Central Tampa Bay (Dec. 13)	10.8	—	<i>Microgobius gulosus</i>	23-37	6	Stunned
			<i>Harengula pensacolata</i>	138	1	Dead

Boca Ciega Bay (Dec. 14)	10.4	32.97	<i>Caranx hippos</i>	120-347	80	Dead and stunned
			<i>Selene vomer</i>	163-287	17	Dead and stunned
			<i>Lutjanus synagris</i>	48-133	4	Dead
			<i>Chilomycterus schoepfi</i>	58	1	Dead
			<i>Monocanthus hispidus</i>	176	1	Dead
			<i>Lactophrys quadricornis</i>	182	1	Dead
			<i>Harengula pensacolae</i>	132	1	Dead
			<i>Mystriophis interinctus</i>	705	1	Dead
			<i>Diodon</i> sp.	62	1	Dead
Coffee Pot Bayou, Tampa Bay (Dec. 14)†	11.8	—	<i>Carnax hippos</i>		100-200	Dead
			<i>Trachinotus falcatus</i>		15	Dead
			<i>Chaetodipterus faber</i>		5	Dead
			<i>Harengula</i> sp.		5	Dead
			<i>Centropomus undecimalis</i>		5	Dead

* The Florida State Board of Conservation also reported this species killed in large numbers on December 13 and 14 in Hillsborough Bay from the Alafia River south to the Ruskin area.

† Data from Mr. Martin Moe, Florida State Board of Conservation. Numbers of fish were estimated.

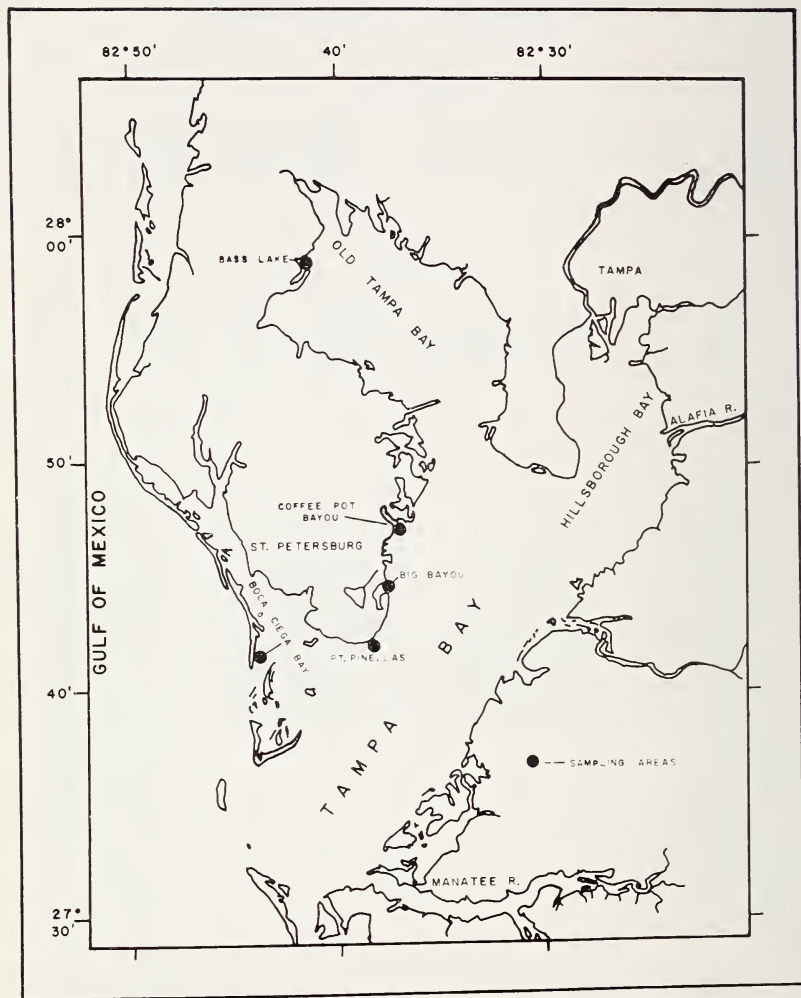


Fig. 1. Stations sampled during fish kills on December 13-14, 1962, in Tampa Bay, Florida.

fish were dead, and those still alive exhibited a loss of equilibrium. The majority of the fish affected were striped mojarra (*Diapterus plumieri*). The tide at this time was low (ebb), and the water was clear. Along the high tide mark, *D. plumieri* were frozen solid, an indication that the kill had begun as the tide receded. The remaining fish collected dead at Bass Lake (table 1) included: brown bullhead (*Ictalurus nebulosus*), spotfin mojarra (*Eucinostomus argenteus*), fantail mullet (*Mugil trichodon*), and snook (*Centropomus undecimalis*). A seine-haul produced the following species which were unharmed: longnose killifish (*Fundulus similis*), gulf killifish (*F. grandis*), sheepshead minnow (*Cyprinodon variegatus*), rain-water killifish (*Lucania parva*), and blackcheek tonguefish (*Symphurus plagiusa*). Juvenile red drum (*Sciaenops ocellata*), common in the area during November, were not collected or seen during the freeze.

In Boca Ciega Bay the first fish kill was noted at 9 a.m., December 14 (table 1). The surface water temperature was 10.4°C and the salinity 32.97 o/oo. Crevalle jack (*Caranx hippos*) appeared to be affected in greater numbers than any other species in that area. We estimated that 300-500 jacks were killed in the areas sampled. These were found dead on the beaches and were netted, in a stunned condition, from the surface of the water. Those on the beaches appeared to have died as the tide receded. The fish collected ranged in size from 120 to 347 mm. but the majority were in two distinct size groups (120-150 mm. and 260-347 mm.). All specimens examined were immature. The second most numerous species affected in the same area was the lookdown (*Selene vomer*). Fourteen of the 17 specimens collected were dead on the beaches, while the others were taken from the surface of the water in a stunned condition. Additional species, collected dead from the beaches in Boca Ciega Bay, included lane snapper (*Lutjanus synagris*), striped burrfish (*Chilomycterus schoepfi*), planehead filefish (*Monocanthus hispidus*), cowfish (*Lactophrys quadricornis*), scaled sardine (*Harengula pensacolae*), spotted spoon-nose eel (*Mystriophis intertinctus*), and porcupinefish (*Diodon* sp.).

Limited kills were observed at Point Pinellas and Big Bayou in central Tampa Bay on December 13 (table 1). Water temperature was 11.2°C, and 10.8°C, respectively, in the two areas. A seine-haul at Point Pinellas produced *F. similis*, *F. grandis*, *C.*

variegatus, tidewater silverside (*Menidia beryllina*), gulf pipefish (*Syngnathus scovelli*), and redfin needlefish (*Strongylura notata*), all in good condition. Young fantail mullet (*M. trichodon*), abundant at Pt. Pinellas during November, were not caught or observed during the freeze.

On December 14, at Coffee Pot Bayou in central Tampa Bay (fig. 1), the water temperature was 11.8°C at 5 p.m. The major species affected was *C. hippos*. Other species killed were permit (*Trachinotus falcatus*), Atlantic spadefish (*Chaetodipterus faber*), *Harengula* sp., and *C. undecimalis* (table 1). All dead fish were observed on the surface or near the shore.

DISCUSSION

Fish kills associated with abnormal temperature reduction are common along the Florida Gulf coast (Storey and Gudger, 1936). The freeze of December 12-14 in the Tampa Bay area was the first and most severe cold spell of the winter. Air and water temperatures dropped rapidly. Nineteen fish species were adversely affected. The dominant fish killed were crevalle jack and striped mojarra. Cyprinodontids were tolerant of the low water temperatures. By December 17 water temperatures had increased in the sampling areas and no additional fish kills were observed.

Springer and Woodburn (1960) reported minor fish kills in the Tampa Bay area on December 13, 1957, when water temperature was as low as 13°C. Snook, barracuda, silver mullet, and striped mojarra were the predominant species affected. These fish kills occurred during another record cold winter when a low water temperature of 8.5°C was reported (Dragovich, Finucane, and May, 1961).

Storey (1937) observed that fish damaged most by a freeze at Sanibel Island, Florida, were tropical and subtropical species. Many of these species were also noted by the authors. They included: *C. hippos*, *L. synagris*, *L. quadricornis*, *C. schoepfi*, *C. undecimalis*, *M. intertinctus*, and inshore lizardfish (*Synodus foetens*). Two species found by the authors but not included in Storey's discussion were *D. plumieri* and *S. vomer*. Briggs (1960) gives the range of *D. plumieri* (*Eugerres plumieri*) as southwestern Florida to Bahia, Brazil, and west to Mexico. Springer and Woodburn (1960) stated that their collection of *D. plumieri* occurred in an

area about 75 miles north of its reported range. This suggests that *D. plumieri* has a tropical and subtropical distribution. Joseph and Yerger (1956) listed *S. vomer* as being characteristic of tropical waters. The lookdown was not known to be common in Tampa Bay. Prior to the kill only three juveniles (28-43 mm.) were collected there in 18 months of sampling. All 17 specimens taken during the freeze were adults.

Our observations suggest that the rapid, short term reduction in water temperatures of Tampa Bay had detrimental effects primarily on tropical and subtropical fish species. Other fish, including the majority of important sport and commercial species, were apparently unharmed. The total effect on local fish populations appeared to be minor.

ACKNOWLEDGMENT

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SUMMARY

Freeze conditions in central Florida during the period December 12 through 14, 1962, lowered water temperatures rapidly in Tampa Bay. The effects of these conditions on Tampa Bay fish were noted. Nineteen fish species, the majority having tropical or subtropical distribution, were observed dead or stunned. *Diapterus plumieri* and *Caranx hippos* suffered the greatest mortality.

LITERATURE CITED

- BRIGGS, JOHN C. 1958. A list of Florida fishes and their distribution. Bull. Florida State Mus., Biol. Sci., vol. 2, no. 8, pp. 223-318.
- DRAGOVICH, ALEXANDER, JOHN H. FINUCANE, AND BILLIE Z. MAY. 1961. Counts of red tide organisms, *Gymnodinium breve* and associated oceanographic data from Florida west coast, 1957-59. U. S. Fish and Wildlife Serv., Spec. Sci. Rept., Fish. no. 369, pp. 1-175.
- GUNTER, GORDON. 1941. Death of fishes due to cold on the Texas coast, January 1940. Ecology, vol. 22, no. 2, pp. 203-208.
- GUNTER, GORDON, AND HENRY H. HILDEBRAND. 1951. Destruction of fishes and other organisms on the South Texas coast by the cold wave of January 28-February 3, 1951. Ecology, vol. 32, no. 4, pp. 731-736.

- JOSEPH, EDWIN B., AND RALPH W. YERGER. 1956. The fishes of Alligator Harbor, Florida with notes on their natural history. Florida State Univ. Stud., no. 22, pp. 111-156.
- SPRINGER, VICTOR G., AND KENNETH D. WOODBURN. 1960. An ecological study of the fishes of the Tampa Bay area. Florida State Board Conserv., Prof. Pap. Ser., no. 1, pp. 1-104.
- STOREY, MARGARET. 1937. The relation between normal range and mortality of fishes due to cold at Sanibel Island, Florida. Ecology, vol. 18, no. 1, pp. 10-26.
- STOREY, MARGARET, AND E. W. GUDGER. 1936. Mortality of fishes due to cold at Sanibel Island, Florida 1886-1936. Ecology, vol. 17, no. 4, pp. 640-649.

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